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ROAD SAFETY AS FUNDAMENT IN ROAD INFRASTRUCTURE PLANNING

ABSTRACT

The road safety is a key indicator for the development of the society. May it be a key factor in the development of the road infrastructure? How will it affect the costs of road planning, construction, and maintenance? Will the "saved costs" from lowering the road accidents cover the higher cost of building and maintaining the roads? All those questions are difficult to answer; some seem even impossible.

Nevertheless, it is important to analyse the problem, establish theoretical models, and formulate hypotheses. So we need to analyse the correlation between road safety, all the costs for road infrastructure, and the social effect in a theoretical manner.

The paper aims to formulate the basis of the problem, and the potential solutions, analyse the needed data, and establish the theoretical models.

KEYWORDS: Road safety, Road infrastructure planning, Costs for road infrastructure

JEL: 018, 021, R58

INTRODUCTION

The scale of external costs generated by transport is steadily increasing. Transport users do not cover a large part of the costs of noise pollution, air pollution, the costs of traffic congestion, and traffic accidents. The costs of traffic accidents are partially covered, mainly through insurance policies, but a large part is still covered by society. In the process of internalizing externalities, the most relevant external costs need to be identified and valued. Although external costs do not have a definite market price, they are partly observed in insurance policy costs, hospital charges, administrative costs, and quality of life losses. An important part of these externalities is traffic accidents, which are a major factor in the stability of road safety.

In this sense, transport accidents are a serious problem for all modes of transport. Their consequences can be horrific, and we know that people are prepared to pay a lot to reduce their own risk of being the victim of a traffic accident. The cost of road accidents worldwide and in Europe is enormous. Part of the problem with road accidents can be explained by the fact that the user, when making a decision, does not take into account all the costs associated with the journey and, in this case, with the accident, i.e. some of the potential damage is external to the user.

All this raises important questions such as - How do we plan the road infrastructure? Which is the fundamental point? What is more important – the costs, the quality, the sustainability, the road safety, the society, the policies? There is not one answer to those questions. Of course, the roads are built for society, and from that point of view, society is the most important. But how do we cover the society's needs? If we build highways everywhere with the best quality is society ready to pay for them? If we built the most sustainable road, will we have the best connections and enough comfort? If we build roads without road accidents will we be ready to cover all the costs and face all the restrictions? All of those questions lead to more questions than answers. There is not a single rule which will meet the criteria. But how do we need to plan our road infrastructure, there must be if not one rule, then a system of rules that lead to the most efficient use of the resources. So, we must formulate what are the fundamental factors for the efficient use of the resources for road infrastructure.

4. METHODOLOGY

Road safety analyses are essential in the overall strategic planning process for road infrastructure development. At the heart of this process is the development of an adequate and accurate methodology for calculating external costs, including those from road accidents. In this respect, the goal of the paper is to examine society's needs and how engineers have to change their approach to meet these needs. The author uses an interdisciplinary approach, cost-benefit analysis, and comparative analysis to illustrate the change in approach to road safety research.

5. Literature review

Road traffic accidents (RTA) are a major but neglected global health problem. They require a clear, reasoned, and coordinated approach for effective prevention. Of all the problems society has to deal with globally, road transport is one of the most complex and dangerous. Road traffic accidents are the eighth leading cause of death, accounting for 3.2% of all deaths worldwide (according to a global study in 2012).

Road accidents happen in a split second, but their consequences can last for months, years, or even the rest of your life. The vast majority of those injured in road traffic accidents recover fully, but others never recover and suffer from various types of disability throughout their lives. In Spain, for example, according to current research, 15% of road traffic accident survivors must be treated in a hospital for at least one day, 32% must be out of hospital for up to three months, and 29% must be out of work for a longer period. In addition to the loss of life or reduced quality of life, traffic accidents carry many other consequences for survivors such as legal, financial, and psychological implications.

In May 2017 the World Health Organization released a report (Bachani, Peden, Gururaj, Norton, Hyder, 2017) on the effect of road traffic accidents, key facts from it are:

- Around 1,250,000 people die each year after a road traffic accident and around 50,000,000 people are injured

- Road traffic accidents are the leading cause of death among people aged 15 to 29, people aged 15 to 44 account for 48% of global road traffic accident fatalities. 73% of road traffic accident victims are men.
- 90% of the world's road deaths are in poor and developing countries, even though only 54% of cars are located there
- Nearly half of those killed on the world's roads are pedestrians, cyclists and motorcyclists
- Road accidents cost most countries 3% of their gross domestic product.

Comparative analysis shows that the problem with traffic safety stayed stable during the period from 2017 to 2023. The proof of this thesis is the statistics for 2023 of the World Health Organization (WHO, Road Traffic Injuries, 2023). According to the organization's data, almost 1.19 million people die each year as a result of road traffic crashes. Road traffic accidents and injuries are in the first place. These injuries cause death for children and young adults aged 5–29 years. Additionally, 92%t of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have around 60% of the world's vehicles. More than half of all road traffic deaths are among vulnerable road users, including pedestrians, cyclists and motorcyclists. The estimation of the organization shows that road traffic crashes cost 3% of the gross domestic product of a single state.

Road safety is a much-debated issue. In recent years, several authors have addressed different aspects. Quite a few of them concentrate on how to calculate accidents in different countries and cities. For example, Sina Rejali, Kayvan Aghabayk, Mohammadali Seyfi, and Oscar Oviedo-Trespalacios investigate the factors for road accidents in New York using a temporal analysis, based on random parameters logit model (Rejali, Aghabayk, Seyfi, Oviedo-Trespalacios, 2024). Other authors focus on driver behavior and how it affects road safety (Moslem, Farooq, Esztergár-Kiss, Yaseen, Senapati, Deveci, 2024).

Another major line of research focuses on using new information technology and Internet-based surveillance and evaluation technologies to analyse road safety; and constructing models for evaluation (Farrag, Heikal, Ahmed, Osama, 2024; Sarkodie, 2024).

There are also analyses in the available literature on road safety and how it is affected by geographical and climatic conditions, especially changes and specifics over time (Hasan, Mahmud, Akter, Sakib, 2024).

The planning of strategic infrastructure in Bulgaria is influenced by the analyses of the most problematic sections of the road network and the opportunities through its construction to solve problems such as improving connectivity and regional development of Bulgarian territories (Tsonkov, Petrov, 2023; Tsonkov, Petrov, 2023; Tsonkov, Petrov, Berberova-Valcheva, 2023). Road safety is also related to strategic planning and construction of road infrastructure in municipalities and improving urban mobility (Nikolova, Petrov, Tsonkov, Zhecheva-Radeva, Grozdanov, 2023).

All these studies show the importance and relevance of road safety and the need for future research in road safety to improve the strategic planning process for road infrastructure.

6. Road safety and strategic road infrastructure planning

Traffic safety encompasses all components of the accident - person, vehicle, road, and environment. Each of these components contributes to crashworthiness and reducing the impact of any one of them will improve road safety. In this sense, by studying road safety, respectively the role of the road on accident rates, additional knowledge and tools will be gained and used to improve road safety. The external costs due to traffic accidents should be internalized and the funds used to improve the road to reduce traffic accidents. This can happen both globally in the definition of national transport policies and strategies and locally in the definition of road design elements. In practice, this means that adding the external costs of road traffic accidents to analyses of the effectiveness of road infrastructure investments can turn a project from ineffective to cost-effective or re-prioritize the construction and maintenance of the road network. The same applies to road design elements, again taking into account the economic impact of external costs due to road traffic accidents, it may be that a certain element is more profitable than another.

We don`t need deep research to find that if the costs are lower, the quality and all other elements are at the lowest point. If we have high quality, we must pay a higher price and society has to be deprived of something else (Nikolova, Tsonevska, 2019). If we are making policies for example with neighbouring countries, we must be ready for compromises. All those correlations are clear. But are the factors mentioned above that may be correlated to all of the others? The costs are the one. That is the reason why during the last decades everything we do for the roads is explained with the costs. We are not building that tunnel because it is very costly; We are building that road because it will help the region to grow economically; We are connecting those transport modes because it will help them grow and lower the costs etc. But what about the other elements? When we are building new roads, we are bringing pollution, noise, and road accident risks (if we don`t have roads, we will not have road accidents). The same can be interpreted the other way – if we build that tunnel we will lower the pollution and noise from other roads, and we will reduce the risks of road accidents. So where is the point that overturns a project from “not to be built” to “to be built”? Do we miss anything when planning? Maybe the answer is yes and not because the scientific research says that, but because we are seeing growing discontent in society towards the road infrastructure. It seems like everything we do is not enough to meet society's needs. Every road is not comfortable enough, or safety enough, green enough, or too costly. So maybe we need to change the approach. But changing the approach is not easy even more we are in a very conservative business under constant monitoring from society. So, what is the best approach to “change the approach”? What I witness is that society explains very well what it wants but it is not happy when it receives it. For example, in urban planning all over the world, there are huge groups of pedestrians and any kind of organization in their favour and the most common thing they want are pedestrian crossings or traffic lights. They assume that if we have pedestrian crossings or traffic lights it will be easier and more safety for pedestrians to move from one point to another, so what they want is not a crossing or traffic lights, but more comfortable and safe movement. The same with

car drivers, they want wider roads or more parking places, assuming that this will make their trip faster and comfort, so they want a faster, more comfortable, and safer trip. But all of them didn`t mention what they wanted but what are the solutions. Are the users those who can give the solutions or do they only need to address the problem?

Figure1. Vision zero "Shared responsibilities".

*Source:*https://visionzeronetwork.org/fundamentals-of-the-safe-system-approach/

According to picture 1 which is fundamental for the Vision Zero approach we have shared responsibilities which is translated as "as soon as the individuals have responsibilities to protect themselves the ones involved in design, construction and maintenance of the infrastructure are responsible to make the road safety enough". At the top of the decision-making process nevertheless are the policy makers. The usual procedure is that the policymakers (after consulting with the planners) propose policies to the society (individuals), and then the society accepts or rejects them (Katsarova, 2022). If the policies are rejected the policy makers rewrite the policies and propose them again to the society. When society accepts them the policies are implemented and we are constantly checking for mistakes from the users which we later try to minimize by making new policies the same way. This circle is repeated again and again the same way and we expect different results. The inefficiency of that approach was shown during

the decade of road safety 2011-2020 as we didn`t manage to go anywhere near the targeted reductions. The new decade 2021-2030 was presented in September 2020 by the UN with the same goal of reducing road traffic deaths by 50%. As of the date of this paper, we are far away from that goal and we will not achieve it again.

Those facts must have our attention and make us think about where are our mistakes and what we have to do to achieve our goals.

At the same time, according to NSI data, in 2019, 6,730 serious traffic accidents were registered in Bulgaria, with 628 killed and 8,499 injured. Compared to the previous year (2018), the number of traffic accidents increased by 0.7%, the number of deaths by 2.9% and the number of injuries by 0.4%. Serious attention should be paid that ¼ of the traffic accidents are "pedestrian hitting".

Of the 628 killed and 8499 injured, 162 killed and 3611 injured were women, and 466 killed and 4888 injured were men. The country, in 2019, is following the global trend - three out of every four people killed are men, with the main casualties due to road accidents being people of working age - 354 killed and 4,722 in the 25-64 age group.

7. RESULTS and Conclusion

We need a new approach (Katsarov, 2019). The critics of the current one is more and more. Nevertheless, we must learn from it and not change it in full but “rearrange it” and put the users on the top. Let`s put the prevention on the top and stop looking backward. The planners and the policymakers are obliged to put the individual's needs in front and plan taking it into account. Society wants simple improvements like more comfort, more user friendly, and mainly safer roads and streets.

It is not difficult to ask the users and understand their needs. This approach is usual in other industries where the „demand determines supply”. If we think of industries close to the roads like automotive we will see that this approach is what drives that industry. The same is true with the business related to the construction sector like material production and technologies and machines needed for the construction.

That is why we have better and better cars, better machines and materials, but not better roads. Changing the approach doesn`t need much resources it needs only to understand that we are those who supply not those who demand!

The conclusion is clear – we must meet society's needs and the society what safer roads. Of course, the experts and planners have to explain what this will cost, and what we will need as time, expertise, resources, and so on, but the approach is clear. The users, the individuals, and the society are on the Top.

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